



## METHOCEL Cellulose Ether

resource

### Chemistry

#### Typical Chemical Structures of METHOCEL Products

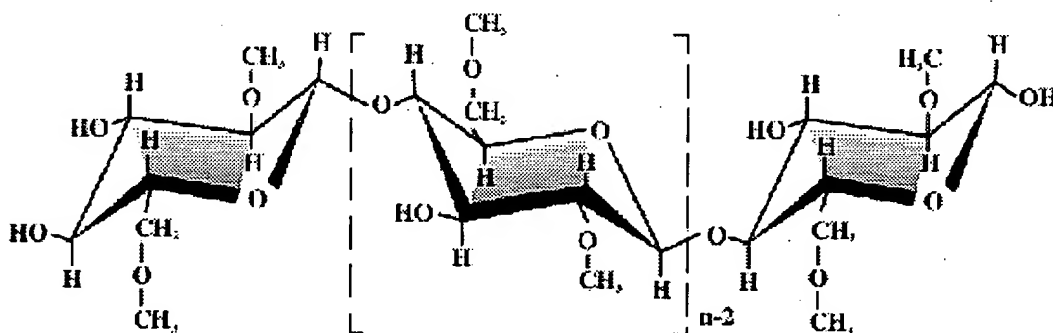
METHOCEL\* cellulose ether products are available in two basic types: methylcellulose and hypromellose†. Both types of METHOCEL have the polymeric backbone of cellulose, a natural carbohydrate that contains a basic repeating structure of anhydroglucose units (see the figure below). During the manufacture of cellulose ethers, cellulose fibers are heated with caustic solution which in turn is treated with methyl chloride, yielding the methyl ether of cellulose. The fibrous reaction product is purified and ground to a fine, uniform powder.

Methylcellulose is made using only methyl chloride. These are METHOCEL A brand products. For hypromellose products (METHOCEL E, F, J, and K brand products), propylene oxide is used in addition to methyl chloride to obtain hydroxypropyl substitution on the anhydroglucose units. This substituent group,  $-\text{OCH}_2\text{CH}(\text{OH})-\text{CH}_3$ , contains a secondary hydroxyl on the number two carbon and may also be considered to form a propylene glycol ether of cellulose. These products possess varying ratios of hydroxypropyl and methyl substitution, a factor which influences organic solubility and the thermal gelation temperature of aqueous solutions.

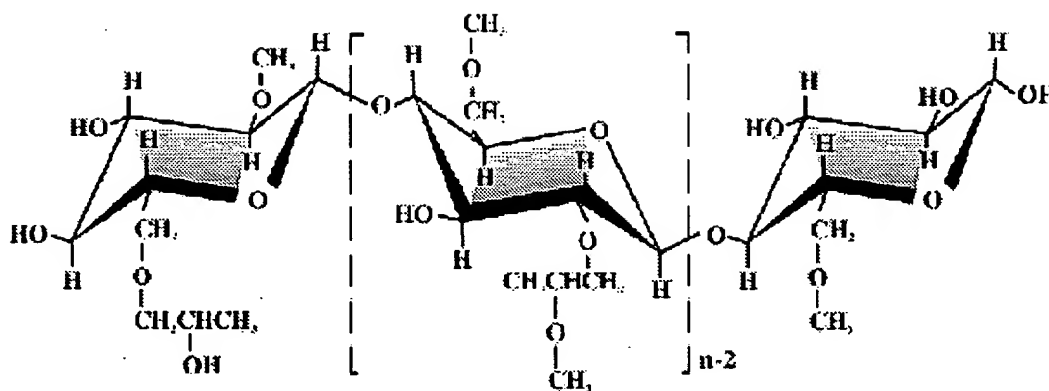
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Methylcellulose - METHOCEL A Products



Hypromellose - METHOCEL E, F, J, K, and 40- Series products



There are also special-grade METHOCEL products available that have been formulated to meet the requirements of specific industries.

### Degree of Substitution

The amount of substituent groups on the anhydroglucose units of cellulose can be designated by weight percent or by the average number of substituent groups attached to the ring, a concept known to cellulose chemists as "degree of substitution" (D.S). If all three available positions on each unit are substituted, the D.S. is designated as 3, if an average of two on each ring are reacted, the D.S. is designated as 2, etc.

The number of substituent groups on the ring determines the properties of the various products. METHOCEL A cellulose ether contains 27.5 to 31.5% methoxyl, or a methoxyl D.S. of 1.64 to 1.92.

In the METHOCEL E, METHOCEL F, and METHOCEL K cellulose ether products, the methoxyl substitution is still the major constituent (see the table below). The molar substitution (MS) reports the number of moles of hydroxypropyl groups per mole of anhydroglucose. In the METHOCEL J and 310-Series products, the hydroxypropyl substitution is about 50% of the total substitution.

**Table 5: Degree of Substitution for METHOCEL Products**

Product	Methoxyl Degree of Substitution	Methoxyl %	Hydroxypropyl Molar Substitution	Hydroxypropyl %
METHOCEL A	1.8	30	--	--
METHOCEL E	1.9	29	0.23	8.5
METHOCEL F	1.8	28	0.13	5.0
METHOCEL J	1.3	18	0.82	27
METHOCEL K	1.4	22	0.21	8.1
METHOCEL 310 Series	2.0	25	0.8	25

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†Previously referred to as hydroxypropyl methylcellulose or HPMC.

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